Remarks/Arguments

Claims 1-2, 4-10, 13-18, 33-35 and 38 are rejected under 35 U.S.C. ¶103 as being unpatentable over Kawasaki et al. (US 4795529) in view of Beaudry (US 3569777).

Applicants contend that claims 1-2, 4-10, 13-18, 33-35 and 38 are not obvious in view of the combined teachings of Kawasaki et al. and Beaudry, and in view of the following representations, reconsideration of the rejection under 35 U.S.C. ¶103 is requested.

I. THE EXAMINER HAS CLEARLY MISINTERPRETED THE TEACHINGS OF BEAUDRY.

In the Office Action, the Examiner states:

> "In response to the argument, examiner states that the argument is not persuasive because *Beaudry teaches an automatic impedance matching network*, which is directly relating the changes in the process parameter (col. 5, lines 11-22).
>
> Beaudry also teaches that impedance will change with the changes in the process parameters such as gas flow rate and pressure (col. 3, lines 13-16).
>
> It is also noted that any impedance matching network measure the mismatch impedance during a process between the generator and the plasma results in loss of power and efficiency and an impedance converter compensate or varies process parameters to provide impedance matching (see col. 1, lines 34-45)."

The Examiner has seriously mischaracterized the contents and teachings of Beaudry.

The Examiner appears to place great reliance on the expression used in Beaudry of an "automatic impedance matching network" (column 5, lines 11-22). Clearly, the Examiner has fixated on the word "automatic", without regard to teachings of Beaudry *as a whole*.

Attention is directed to the attached DECLARATION OF DR. LESLIE LEA UNDER 37 C.F.R. ¶132.

Dr. Lea, in his Declaration, addresses the issue of what is meant by Beaudry's phrase "automatic impedance matching network" and, once again, explains how the device of Beaudry actually works.

To reiterate, Beaudry does not disclose a system which can compensate for any impedance mismatch by adjusting one or more of the processing parameters. In stark contrast, the impedance matching unit of Beaudry is a passive device which uses fixed and pre-set circuit components to provide a generally low Q factor. As a result of this, the impedance matching network can approximately satisfy the impedance matching requirement over a broad envelope of parameter values. Therefore, the impedance matching unit of Beaudry is pre-set and nonadjustable.

It is clear that (i) Beaudry fails to disclose the adjustment of one or more of the processing parameters in order to compensate for any impedance mismatch, and (ii) Beaudry document actually teaches away from the solution.

The comments put forward in paragraph 8 of Dr. Lea's Declaration are absolutely correct. The term "automatic" in Beaudry refers to the ability of the impedance matching network to approximately satisfy the impedance matching requirement over a broad envelope of parameter values. This ability is due to the pre-set and passive internal configuration of the impedance matching network, and is not – and cannot be – due to any process of adjustment during the etching.

The Examiner takes out of context the passage appearing at column 3, lines 13-16 of Beaudry. That is, this passage merely explains that impedance will change with changes in process parameters such as gas flow rate or pressure. However, this passage does not at all suggest that a deliberate impedance compensation step could be taken so as to stabilize the plasma during one of the transition stages.

Likewise, the Examiner takes out of context the passage appearing column 1, lines 34-45 of Beaudry. This passage is in fact referring to the prior art, and not the Beaudry invention. When read in context, it can be seen that Beaudry is criticizing prior art arrangements in which some form of manual adjustment is made, and seeks to address the issue by providing a pre-set and passive network which does not require adjustment.

Thus, contrary to the Examiner's apparent suggestions, Beaudry is directed to the passive ability to provide impedance matching without adjustments being made.

II. EVEN IF THE IMPEDANCE MATCHING CIRCUIT OF BEAUDRY WAS SOMEHOW INCORPORATED INTO KAWASAKI ET AL., THE RESULTANT COMBINATION WOULD NOT CORRESPOND TO THE NOW PENDING CLAIMS.

As previously discussed in detail, the apparatus of Beaudry is not adjustable or controllable after initial set-up. Instead, the impedance matching unit of Beaudry is constructed to have a generally low Q factor, which allows it to approximately match to a range of plasma conditions. Beaudry provides limited impedance matching by way of a non-adjustable construction which exhibits tolerance to (relatively small) changes in plasma impedance rather than being controllable to compensate for such impedance changes.

It is thus readily apparent that hypothetical combination of Beaudry and Kawaski et al. would not produce a method or apparatus falling within the scope of the rejected claims.

This is at least because independent claims 1 and 33 specify that the compensation for the impedance mismatch is by way of adjusting a processing parameter of the processing apparatus so as to stabilize the plasma during at least one of the defined transitions. Beaudry and Kawasaki et al. are both entirely devoid of any such teachings.

Therefore, even if the cited references were somehow combined in the manner put forward by the Examiner the resulting combination would not fall within the scope of claims 1 and 33.

III. ONE OF ORDINARY SKILL WOULD NOT INCORPORATE THE IMPEDANCE MATCHING CIRCUIT OF BEAUDRY INTO KAWASAKI ET AL. IN THE FASHION SUGGESTED BY THE EXAMINER

It appears from the record that the present obviousness rejection has been made with hindsight, benefiting from the insight provided by the present application, which of course is not permissible.

The present invention concerns a particular, switch process in which alternate etching/deposition steps are performed cyclically (see page 1, line 13 to page 2, line 8). This process in particularly useful since it enables highly anisotropic etches to be performed allowing high aspect ratio trenches to be produced. Kawaski et al. disclose examples of a cyclical, alternate etching/deposition technique.

The present invention at least partially stems from the insight that the cyclical, alternate etching/deposition technique suffers from a problem in the transition regions between the etching and deposition steps and from the deposition to etching steps. This problem is that the plasma impedance can vary rapidly and dramatically, leading to plasma instability or even extinguishing of the plasma (see, for example, page 13 of the present application). Kawasaki et al. teaches a cyclical and alternating etching/deposition technique, but does not teach or even suggest that there may

be a problem in the transition regions, let alone suggest what the solution might be.

In the meantime, Beaudry is wholly concerned with producing and sustaining a plasma in a single etching phase. Beaudry is not concerned with the cyclical, alternate etching/deposition technique, and does not disclose the above-mentioned problem at all. Thus, none of the cited prior art documents disclose or even suggest the fundamental problem addressed by the present invention, and so there would be no motivation whatsoever for the skilled person to combine these documents.

Further, even if one skilled in the art was aware of the severe problem presented by the relatively large and rapid fluctuations in plasma impedance in the transition regions, such a person would understand that the hypothetical combination suggested by the Examiner would not work. In other words, even if the impedance matching unit of Beaudry was somehow introduced into the apparatus of Kawaski et al., the resulting system would not be suitable for use in the cyclical, alternate etching/deposition process. This is at least partly because the system of Beaudry is not suitable for coping with the potentially severe and rapid fluctuations in plasma impedance which occur in the transition regions.

IV. CONCLUSION

No other issues remaining, reconsideration and favorable action upon the claims now pending in the application are requested.

Respectfully submitted,

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Attachments: DECLARATION OF DR. LESLIE LEA UNDER 37 C.F.R. ¶1.132

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